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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No.

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Huei-Min	Ke	Taipei, Taiwan

Additional inventors are being named on the ___/___ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

Local Exhaust System for Toilets and Urinals

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ Customer Number:

OR

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ENCLOSED APPLICATION PARTS ***(check all that apply)***

☑ Specification *Number of Pages* 10 ☐ CD(s), Number ______

☑ Drawing(s) *Number of Sheets* 5 ☐ Other (specify) ______

☐ Application Data Sheet. See 37 CFR 1.76

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☑ Applicant claims small entity status. See 37 CFR 1.27.

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Respectfully submitted,

SIGNATURE Huei-Min Ke

TYPED or PRINTED NAME Huei-Min Ke

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Date Mar 1, 2004

REGISTRATION NO. ______
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Docket Number: ______

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INVENTOR(S)/APPLICANT(S)		
Given Name (first and middle [if any])	Family or Surname	Residence (City and either State or Foreign Country)
Liang-Yi	Ke	Taipei, Taiwan

Number 1 of 1

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TOTAL AMOUNT OF PAYMENT	($) 80.00

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First Named Inventor	Huei-Min Ke
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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	80.00

SUBTOTAL (1) ($) 80.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=	
Independent Claims		- 3** =		X		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

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FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____________

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SUBTOTAL (3) ($)

SUBMITTED BY				(Complete *(if applicable)*)	
Name *(Print/Type)*	Huei-Min Ke	Registration No. *(Attorney/Agent)*		Telephone	+886-928550197
Signature	Huei-Min Ke			Date	Mar 1, 2004

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Provisional Patent Application of

Huei-Min Ke

Liang-Yi Ke

For

TITLE: LOCAL EXHAUST SYSTEM FOR TOILETS AND URINALS

CROSS-REFERENCE TO RELATED APPLICATION: None.

FEDERALLY SPONSORED RESEARCH: None.

SEQUENCE LISTING: None.

BACKGROUND

This invention relates to the special arrangement and operation of ventilating accessories for lavatories, specifically to devices ventilating the toilet and urinal bowls.

The poor air quality of toilets has already been taken for granted, especially for frequently used public toilets. Because the mechanism of general ventilation is adopted, it demands high ventilation volume to dilute toilet odor (50 cfm per person for public restrooms vs. 20 cfm per person for office space, ASHRAE Standard 62-1989), but the effect is usually dissatisfying. Not only because toilet compartments stagnate air contaminants, but also human noses are sensitive to these air pollutants emitting from human wastes. Several offensive odorous compounds in human feces and urine have extremely low odor detection thresholds, which is the minimum concentration of a substance at which a majority of test subjects can detect. For example, the detect threshold is 0.5 ppb for hydrogen sulfide, and 0.5 ppb for methyl mercaptan. This means, if general ventilation devices could not dilute them to sub ppb levels before they disperse into breathing zones, it will not be odorless. Local

exhaust ventilation would be much more effective for toilet odor control, because in comparison with the large dilution airflow which general ventilation devices have to provide, for local exhaust devices, only a smaller airflow is required to overcome the diffusion, convection, and low initial velocity of air contaminants with low detection thresholds.

Many inventors have created many types of local exhaust devices for toilets, most of them are special configurations of bowl rims or ventilating accessories to control toilet odor at their sources. U.S. patent 5,809,581 to Brown (1998) showed a seat-type toilet bowl being structured to have an air duct which leading away from the hollow upper rim interior to a conduit, the conduit leading to an air exhaust port, and a fan positioned within the conduit proximate the exhaust port. This device is designed for private dwelling toilets, not for public toilets or lavatories with a plurality of toilets, for there is no duct system. Besides, from the rationale of industrial ventilation, this device only finished the first stage in airhood design phase, that is, to invent an airhood distributing the exhaust airflow evenly. There are still other important concepts in this phase, e.g. capture velocity; when the face velocity of an airhood attains it, the contaminants would be completely captured and removed. The toilet air quality is a function of ventilation volume. Without exhaust airflow design concepts, the odor control effect is not assured.

Taiwan patent publication No. 00205832 "Toilet Exhaust Device" (FIG. 1 and 2) to Liang-Yi Ke (1993), one of us, also showed a seat-type ventilated toilet with an air duct located in its bowl rim. Furthermore, between its air outlet and terminal conduit, there is a damper to regulate the airflow to distribute it evenly among ventilated toilets. However, this damper could not be installed and adjusted if the air outlet is mounted in wall or underground. It has provided preliminary ideas in duct design phase, but further compliance with the rationale of industrial ventilation is still needed.

Taiwan patent application No. 92210502 "Squat-type Toilet Configuration Improvement" (FIG. 3, 4, 5, and 6) by Liang-Yi Ke, one of us, showed a squat-type ventilated toilet and a ventilated urinal both have air ducts located in their bowl rims. Furthermore, the exhaust airflow rate of the ventilated toilet should be 1.2 times larger than the flush flow rates. This has offered an idea in ventilation volume requirement, but again, further compliance with the rationale of industrial ventilation is needed.

Except odor problem, flushing toilets places pressure upon fluid in bowls and generates aerosols, which will disperse if there is no local exhaust devices. If the aerosols carry infectious microorganisms, toilet users could contact with or inhale them. In 1975, Charles P.

Gerba concluded: " Droplets produced by flushing toilets were found to harbor both bacteria and virus which had been seeded. The detection of bacteria and viruses falling out onto surfaces in bathroom after flushing indicated that they remain airborne long enough to settle on surfaces throughout the bathroom. Thus, there is a possibility that a person may acquire an infection from an aerosol produced by a toilet" (Microbiological Hazards of Household toilets: Droplet Production and the Fate of Residual Organisms, Applied Microbiology, Aug. 1975, p.229-237, Vol. 30, No.2). Besides, in 2003, the investigation report of World Health Organization about the outbreak of Severe Acute Respiratory Syndrome (SARS) at Amoy Gardens, Hong Kong concluded the possibility of droplet transmission. It was aerosolized from patients' feces and urinal within a faulty plumbing system, and dispersed to other apartments of the building through the light well by exhaust fans. For the same reason, one of precautionary measures to prevent SARS transmission in hospitals requires "lower the lid before flushing to prevent water in the toilet bowl from splashing."

Insofar as we are aware, there is not a total solution formerly developed to control toilet odor and bioaerosol effectively. It is therefore the purpose of this invention. Accordingly, the objectives and advantages of this invention are:

(a) to provide a local exhaust system for effective toilet odor and bioaerosol control.

(b) to precisely define the requirement of exhaust airflow rates, then it would become the basis for duct and fan designs.

(c) to provide a capture hood to measure airflow, so the desired airflow rate would be tested and adjusted.

(d) to provide an adjustable airflow control device, so it could meet every specific customer's need.

(e) to provide a local exhaust system to incorporate all types of ventilated toilets and urinals.

(f) to provide a local exhaust system with low equipment, installation, operation, and maintenance costs.

(g) to provide a local exhaust system with low operation noise.

(h) To provide an effective toilet odor control system to minimize the flushing water for odor eliminating purpose, especially when or where water supply is insufficient. Theoretically, if the air exhaust airflow rate is well designed, and a toilet can perform as an

ideal airhood, it will be odorless even without flushing.

(i) to provide an effective toilet odor control system to reduce the ventilation volume requirement of public toilets. This also reduces the HVAC operation cost incidentally.

(j) to incorporate toilets and urinals with other negative pressure devices as engineering control in hospitals, especially for SARS wards, to minimize the possibility of droplet transmission by bioaërosol from flushing toilets.

Further objects and advantages of this invention will become apparent from a consideration of the drawings and ensuing descriptions.

SUMMERY

The invention, a total solution for toilet odor and bioaerosol control, has terminal conduits connecting to each ventilated toilet and urinal within a lavatory. A damper or blast gate, as a pressure-balancing device, is positioned within each terminal conduit to distribute the airflow. All terminal conduits connect to a main conduit of the lavatory by junctions. A fan is positioned proximate the exit of this local exhaust system to overcome the total pressure loss. The exhaust airflow rate for each type of ventilated toilet and urinal is designed according to the criteria of acceptability, capture velocity, odor intensity, odor concentration, or bioaerosol doses. Conduits, dampers, and the fan are installed to exhaust air from each ventilated toilet and urinal to attain desired criteria. A capture hood with a seal plate and a seal gasket is provided to test, adjust, and balance the exhaust airflow. The damper or blast gate is adjustable to meet specific customer's need.

DRAWINGS

FIG. 1 is a perspective view of prior art: a seat-type ventilated toilet.

FIG. 2 is a cross section view of toilet bowl rim of FIG. 1.

FIG. 3 is a perspective view of prior art: a squat-type ventilated toilet.

FIG. 4 is a cross section view of toilet bowl rim of FIG. 3.

FIG. 5 is a perspective view of prior art: a ventilated urinal.

FIG. 6 is a cross section view of urinal bowl rim of FIG. 5.

FIG. 7 is a perspective view of a local exhaust system constructed in accordance with this invention.

FIG. 8 is a perspective view of a configuration of using a capture hood.

FIG. 9 is a system diagram of this invention.

DETAILED DESCRIPTION

FIG. 1 is a perspective view of prior art: a seat-type ventilated toilet 11 incorporated in the invention. The toilet bowl rim 21 is composed of an upper portion: air duct 13 and a lower portion: water duct 12. The air duct 13 collects and transports exhaust air to air outlet 14. The water duct 12 transports water from a water inlet 15 and distributes them to the bowl.

FIG. 2 is the cross section view of the toilet bowl rim 21 of FIG. 1. The air duct 13 has a plurality of exhaust holes 23 to distribute the exhaust airflow evenly. The water duct 12 also has a plurality of drainage holes 22 to distribute flush water evenly.

FIG. 3 is a perspective view of prior art: a squat-type ventilated toilet 31 incorporated in this invention. The toilet bowl rim 41 is composed of an upper portion: air duct 32 and a lower portion: water duct 33. The air duct 32 collects and transports exhaust air to an air outlet 34. The water duct 33 transports water from a water inlet 35 and distributes it to the bowl.

FIG. 4 is the cross section view of the toilet bowl rim 41 of FIG. 3. The air duct 32 has a plurality of exhaust holes 43 to distribute the exhaust airflow evenly. The water duct 33 also has a plurality of drainage holes 42 to distribute flush water evenly.

FIG. 5 is a perspective view of prior art: ventilated urinal 51 incorporated in this invention. The urinal bowl rim 61 is hollow to collects and transports exhaust air to an air outlet 53. The flush water is transported from a water inlet 52 and distributes them to the bowl.

FIG. 6 is the cross section view of urinal bowl rim 61 of FIG. 5. The air duct 63 located within the urinal bowl rim 61 has a plurality of exhaust holes 62 to distribute the exhaust airflow evenly.

FIG. 7 is a perspective view of a local exhaust system constructed in accordance with this invention. Within each set of toilet compartment 76, there is a terminal conduit 78 connecting to a seat-type ventilated toilet 11 with the air outlet 14. Each terminal conduit 78 connects to the main conduit 73 of the lavatory by a junction 72. A damper 75 is positioned within each terminal conduit 78 for pressure balancing. A fan 71 is positioned at an end of

main conduit 73 to exhaust contaminated air out the lavatory. The other end of main conduit 73 is installed with an end cap 74 for further extension.

FIG. 8 is a perspective view of a configuration of using a capture hood 85. It is composed of a transition 82 positioned upon a seal plate 83 with a seal gasket 84 to prevent air leakage. While measuring airflow rates, the capture hood 85 is pressed upon a seat-type ventilated toilet 11, then an anemometer 81 is placed upon capture hood 85.

FIG. 9 is a system diagram of this invention. Within each lavatory 93, there is one or a plurality of seat-type ventilated toilets 11, squat-type ventilated toilets, and/or ventilated urinals. All of them connect to a main conduit 73 of the lavatory by terminal conduits 78. A damper 75 is positioned within each terminal conduit 78. If the main conduit 73 for a lavatory 93 connects to parent section of main conduit 92, then a damper 75 is positioned before the connection point. An odor control filter 91 is positioned before the fan 71 to eliminate odor.

REFERENCE NUMERALS

11 seat-type ventilated toilet

12 water duct

13 air duct

14 air outlet

15 water inlet

21 toilet bowl rim

22 drainage hole

23 exhaust hole

31 squat-type ventilated toilet

32 air duct

33 water duct

34 air outlet

35 water inlet

41 toilet bowl rim

42 drainage hole

43 exhaust hole

51 ventilated urinal

52 water inlet

53 air outlet

61 urinal bowl rim

62 exhaust hole

63 air duct

71 fan

72 junction

73 main conduit

74 end cap

75 damper

76 toilet compartment

78 terminal conduit

81 anemometer

82 transition

83 seal plate

84 seal gasket

85 capture hood

91 odor control filter

92 parent section of main conduit

93 lavatory

OPERATION

In operation of this local exhaust system, it is essential to determine the respective required exhaust airflow rate of the seat-type ventilated toilet 11, the squat-type ventilated toilet 31, and the ventilated urinal 51. Since their bowls, as airhoods of local exhaust devices, have different shapes and different relative positions to users. Several criteria are suggested:

(a) Perceived air quality % dissatisfied. Presently, indoor air ventilation is designed to provide an acceptable perceived air quality, which is a function of ventilation volume while tested in laboratory. A similar experiment with this local exhaust system for toilets and urinals can be conducted in lavatories to assess the acceptability of the toilet odor. The percentage of users perceiving the toilet odor to be unacceptable is a function of the exhaust airflow rate. Then different levels of % dissatisfied can be selected, and the corresponding exhaust airflow rates can be determined. Refer to ASHRAE Standard 62-2001, Ventilation for Acceptable Indoor Air Quality, American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc.

(b) Capture Velocity. It is the minimum air velocity needed to draw contaminants into an airhood, measured on the face of the airhood. A capture velocity of 50-100 fpm is recommended (Industrial Ventilation, ACGIH) for air contaminants leaving their source with zero initial velocity. Then the exhaust airflow rates would be determined when its face velocity attains the capture velocity. Refer to Industrial Ventilation: A Manual of Recommended Practice, 25th Edition, The American Conference of Governmental Industrial Hygienists (ACGIH).

(c) Odor concentration and odor intensity. Odor concentration is a measurable characteristic of odor sensation. It is measured in term of number of dilutions with odor-free air needed to reduce an odor to its detection threshold. Odor intensity is the perceived strength of odor sensation. They are the current approaches used in USA relative to odor regulations and guidelines. Similar to (a) perceived air quality % dissatisfied, different levels of acceptable odor concentrations or odor intensities can be selected, then the corresponding exhaust airflow rates can be determined. Refer to ASTM E679-91 (1997) Standard Practice for Determination of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits, and ASTM E544-99 Standard Practices for Referencing Suprathreshold Odor Intensity, American Society for Testing and Materials.

(d) Bioaerosol doses. The numbers of bacteria and viruses ejected from a toilet flush can be calculated with assays, which are collected by cotton gauze placed in lavatories. It would be a function of exhaust airflow rate with ventilated toilets. Different minimum infectious doses of concerned diseases can be selected, then the corresponding required exhaust airflow rates can be determined. Also refer to Charles P. Gerba, Microbiological Hazards of Household toilets.

While the exhaust airflow rate of each ventilated toilet and urinal is determined, it comes

to the phases of duct and fan designs. Engineers could follow the concept showed in FIG. 7 and FIG. 9. A terminal conduit 78 connects to their respective air outlet of ventilated toilets and urinals 14, 34, and 53. A damper 75 (or blast gate) is positioned within each terminal conduit 78 for pressure balancing. All terminal conduits 78 connect to the main conduit 73 by junctions 72. If the main conduit 73 of a lavatory connects to parent section of main conduit 92 (as in FIG. 9), a damper 75 is positioned before the connection point for pressure balancing. An odor control filter 91 is provided if the exhaust air causes odor nuisance to neighborhood. The local loss coefficient of each ventilated toilet and urinal can be tested, which is a function of its respective geometry of exhaust holes 23, 43, and 62, air ducts 13, 32, and 63, and air outlets 14, 34, and 53. After duct design is finished, then a fan 71 overcoming total pressure loss can be selected, and the desirable local loss coefficient of each damper 75 can be determined. Refer to ASHRAE Handbook 2001 – Fundamentals, Chapter 32 Duct Design and Chapter 22 Industrial Ventilation, and Industrial Ventilation: A Manual of Recommended Practice, 25th Edition, ACGIH.

After the installation of a local exhaust system, a capture hood 85 is provided to test, adjust, and balance the exhaust airflow rate of each ventilated toilet and urinal. Press the seal plate 83 and seal gasket 84 to prevent air leakage. A transition 82 is provided to distribute the airflow. An anemometer 81 is placed upon the capture hood 85 to measure airflow rates. The increment of local loss coefficients of ventilated toilets while using a capture hood 85 can be tested to calculate the actual airflow rates. After the commission, the damper 75 could be adjusted to meet specific customer's need. The fan 71 can be changed if it do not meet the new total pressure requirement.

Thus the reader will see that the local exhaust system for toilets and urinals provide a total solution for toilet odor and bioaerosol control. While my above description contains many specificities, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of preferred embodiments. Many other variations are possible. For example:

Another fan can incorporate with this system to introduce outdoor fresh air while a lavatory is located in confined space or without proper fresh air intake mechanism.

An ultraviolet germicidal irradiation (UVGI) device and a high efficiency particulate air (HEPA) filter can be incorporated into this system in negative pressure wards of hospitals, or where recycling the exhaust air is necessary.

For energy management purpose, this system can installed with a sensory to detect the usage of each toilet or lavatory to activate the fan or damper.

CLAIM

1. A local exhaust system for toilets and urinals, comprising:

A terminal conduit connecting to the air outlet of each ventilated toilet and urinal within a lavatory. A pressure-balancing device is positioned within each terminal conduit to distribute the airflow. All terminal conduits connect to a main conduit of the lavatory by junctions. A fan is positioned proximate the exit of this local exhaust system to overcome total pressure loss.

The exhaust airflow rate for each type of ventilated toilet and urinal is designed according to the criteria of acceptability, capture velocity, odor intensity, odor concentration, or bioaerosol doses, as the basis for duct and fan designs.

Conduits, dampers, and the fan are installed to exhaust air from each ventilated toilet and urinal bowl to attain desired exhaust airflow rates. A capture hood with a seal plate and gasket is provided to test, adjust, and balance the exhaust airflow. The damper is adjustable to meet specific customer's need.

ABSTRACT

A local exhaust system is designed for a total solution to control toilet odor and bioaerosol comprises a terminal conduit (78) connecting to each ventilated toilet and urinal within a lavatory. A damper (75) is positioned within each terminal conduit to distribute airflow. All terminal conduits connect to a main conduit (73) of a lavatory. A fan (71) is positioned proximate the exit of main conduit to exhaust air from toilet and urinal bowl. The exhaust airflow rate for each type of ventilated toilet and urinal is designed according to the criteria of acceptability, capture velocity, odor intensity, odor concentration, or bioaerosol doses. A capture hood is provided to test, adjust and balance the exhaust airflow. The damper is adjustable from customer's feedback to meet the specific need.

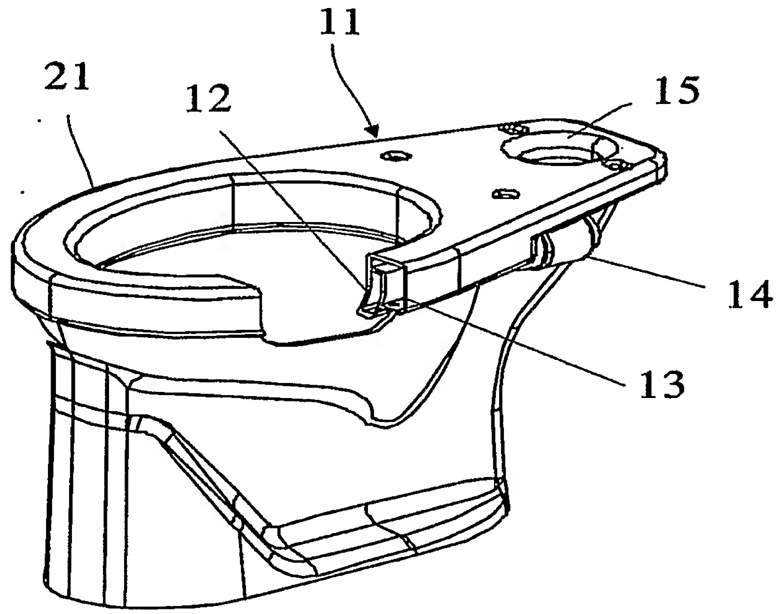

FIG. 1 Prior Art

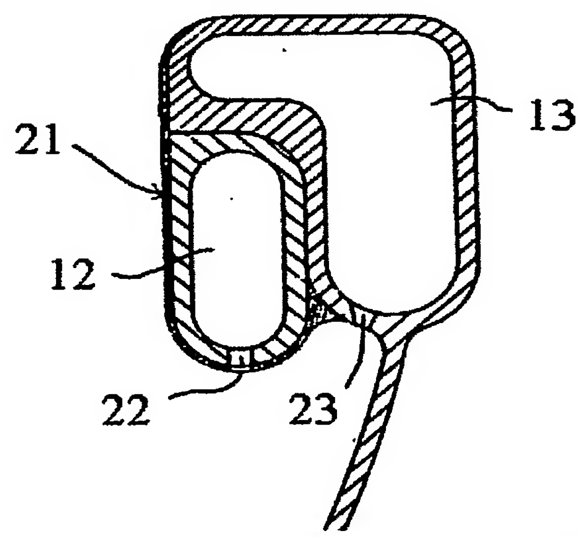

FIG. 2 Prior Art

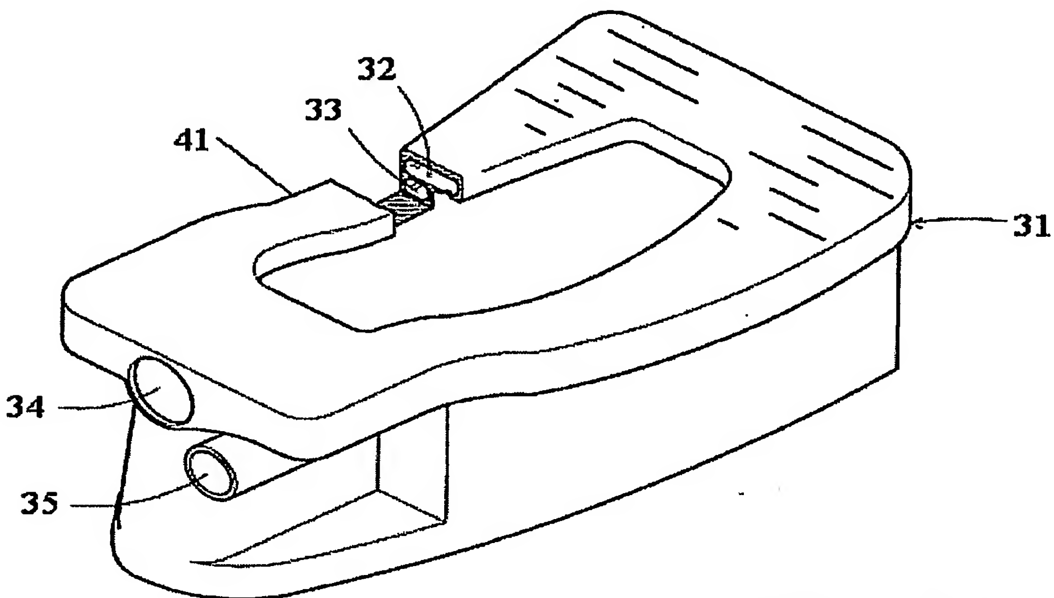

FIG. 3 Prior Art

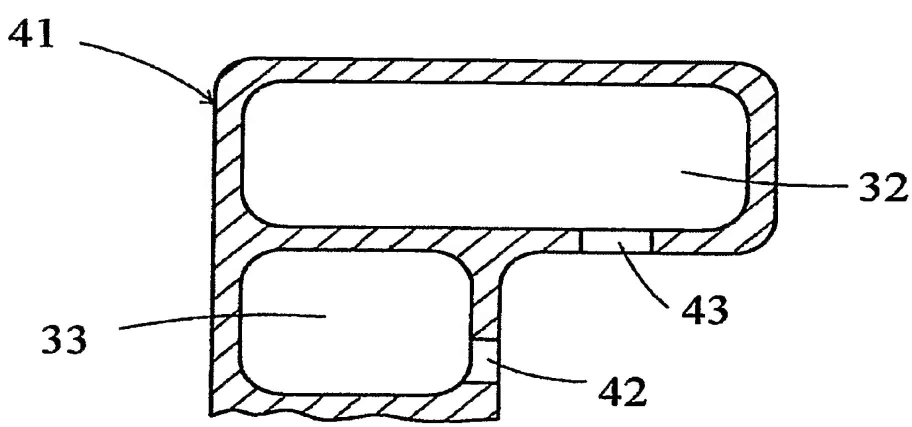

FIG.4 Prior Art

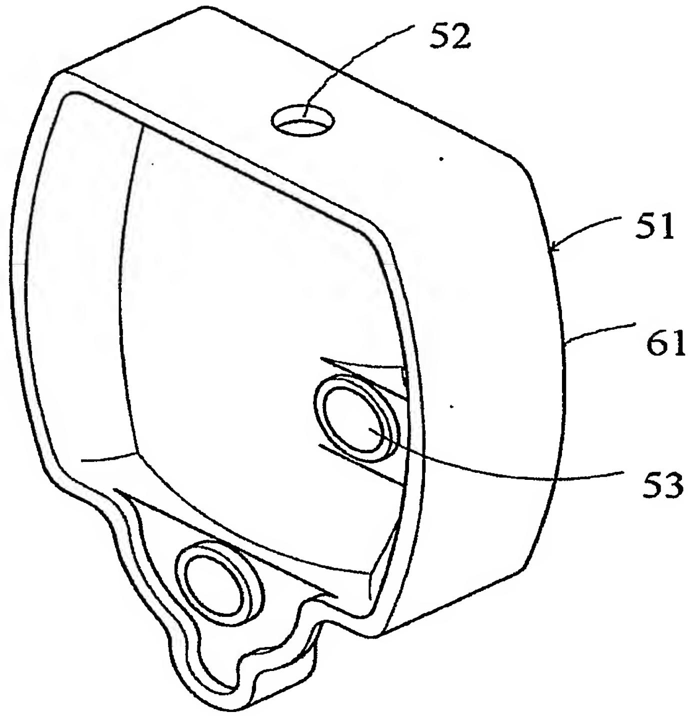

FIG. 5 Prior Art

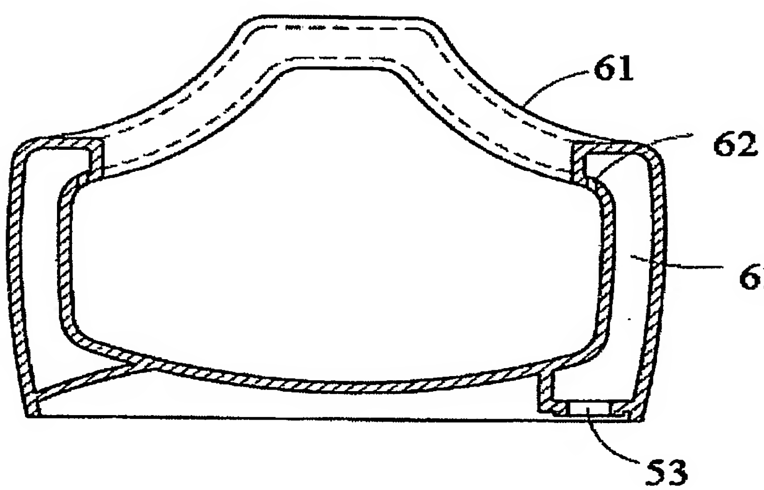

FIG.6 Prior Art

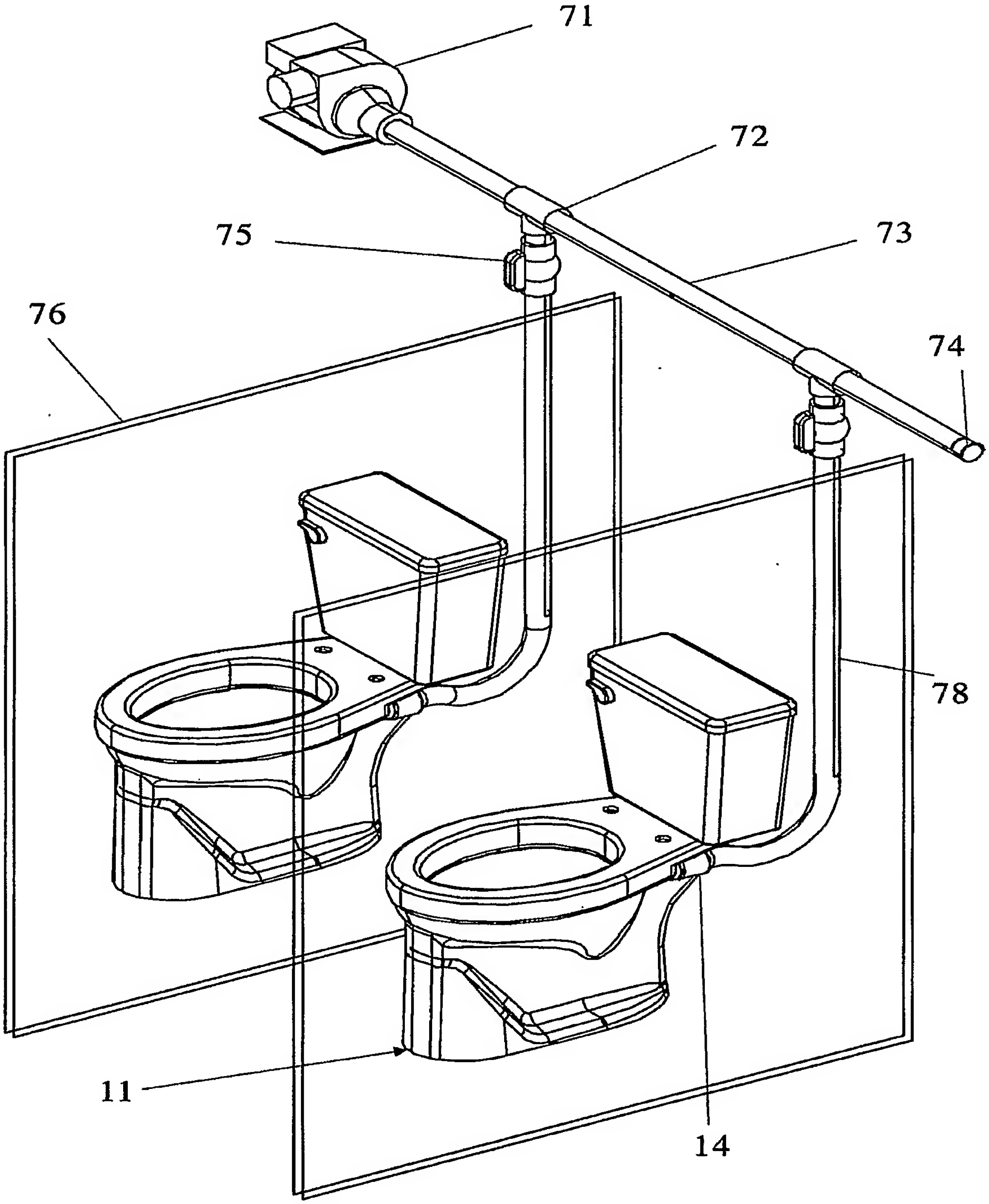

FIG.7

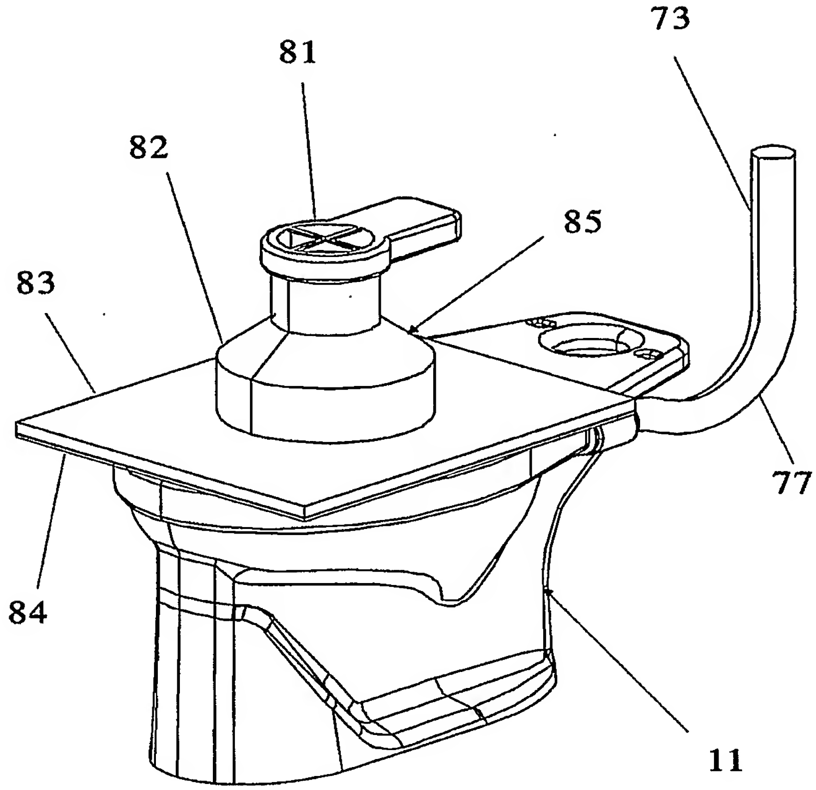
73
81
82
85
83
77
84
11

FIG.8

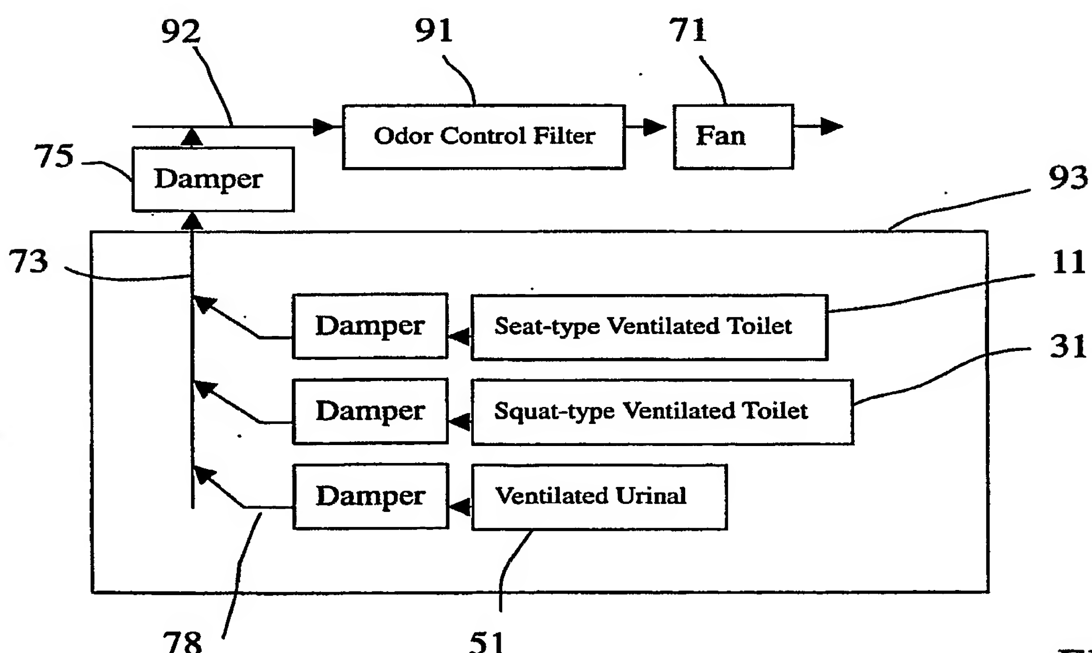
92
91
71
Odor Control Filter
Fan
75
Damper
93
73
11
Damper
Seat-type Ventilated Toilet
31
Damper
Squat-type Ventilated Toilet
Damper
Ventilated Urinal
78
51

FIG.9